REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
09/19/2017	Abstract	

4. TITLE AND SUBTITLE
Case Report: Rhabdomyolysis in Service Member following SERE physical training.

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Capt Matthew A Pombo

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
59th Clinical Research Division
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JBSA-Lackland, TX 78236-9908
210-292-7141

8. PERFORMING ORGANIZATION REPORT NUMBER
17379

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
59th Clinical Research Division
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JBSA-Lackland, TX 78236-9908
210-292-7141

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release. Distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Case Report: Rhabdomyolysis in Service Member following SERE physical training.
Authors: Matthew A. Pombo, DO (Capt, USAF); Dwaipayan Chakraborti, MD (MAJ, USA); Joseph Marcus, MD (Capt, USAF); Andrew Wyatt, DO (Capt, USAF); Austin Flowers, BS.Rhabdomyolysis, to state it simply, is a syndrome of the breakdown of muscle tissue and the release of toxins into the blood. The patient will often present with extreme muscle cramping and dehydration. This is further quantified by elevated creatine kinase and myoglobinuria on laboratory analysis.
The spectrum of rhabdomyolysis is wide, including completely asymptomatic all the way to a severe and debilitating syndrome. The clinical presentation may include muscle pain, cramping, swelling, weakness, dark urine, electrolyte abnormalities, hypovolemia, and in severe cases potential compartment syndrome, disseminated intravascular coagulation and debilitating kidney injury. Rhabdomyolysis "develop[s] as a result of a physiological cascade of metabolic abnormalities that occurs when the body is no longer able to compensate for the demands placed upon it."1

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Clarice Longoria
					19b. TELEPHONE NUMBER *(Include area code)* 210-292-7141

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Rhabdomyolysis, to state it simply, is a syndrome of the breakdown of muscle tissue and the release of toxins into the blood. The patient will often present with extreme muscle cramping and dehydration. This is further quantified by elevated creatine kinase and myoglobinuria on laboratory analysis.

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Rhabdomyolysis occurs predominantly in patients who are "male sex, younger age, a prior heat injury, lower educational level, lower chronic physical activity, and activity in the warmer months of the year."[3] For individuals who are presenting with extreme muscle cramping, dehydration, and weakness, a complete evaluation should occur. This should include a history, especially of recent exercise activity, physical exam, and be accompanied with a raised index of suspicion that will aid in correctly diagnosing and getting patients to an elevated level of care.

Case 1

A 24 year-old active duty male in Survival, Evasion, Resistance, and Escape (SERE) training who started complaining of muscle cramps after completing a 4-mile 65 lbs. ruck march in less than 1 hour in the hot summer sun. He then completed a 1-mile sprint with increasing muscle cramping in his lower extremities. He presented to the Independent duty medical technician (IDMT), stating that now his hamstrings and right arm were cramping.

The patient has had similar problem in the past and takes a magnesium supplement. At that time, the assessment included a laboratory analysis of a chemistry to evaluate electrolytes and kidney function and creatine kinase were ordered. Patient was released back to duty. The patient was able to complete a Crossfit work out followed by another 1-mile sprint in the same day. At this time, the patient was complaining of increasing muscle cramping globally in his chest, arms, abdomen, and legs with some accompanied dizziness, light-headedness and extreme diaphoresis.

The laboratory results came back that night with a creatine kinase at 11686 IU/L; where normal CK rarely elevates above 200 IU/L. The patient was brought to the urgent

care center where repeat labs were performed. On repeat labs, the CK was greater than 17,000 UI/L. The patient was admitted to the local hospital for rhabdomyolysis. Patient denied any dark urine at this time.

The patient was fluid resuscitated with initial 2L bolus and maintenance fluids that ran at rates of up to 600cc per hour. The patient received almost 6L per day of fluid resuscitation over 3 days before the CK started to decrease. This was a muscular male so there was never a significant rise in creatinine, an indicator of acute kidney injury. A mild electrolyte abnormality of hypokalemia was corrected with oral potassium supplementation on day 2. The patient developed mild abdominal pain that was treated with oral Tylenol. The patient was managed with serial physical exams to check for compartment syndrome and fluid overload, serial labs to monitor for CK, and a renal function panel to observe electrolytes and kidney injury status. This patient made a full recovery after a 4 day hospitalization and was able to resume active duty with no limitations.

Editorial Comment

Rhabdomyolysis is not an uncommon presentation in the military trainee and military service members. "Among active component service members in 2016, there were 525 incident diagnoses of rhabdomyolysis likely due to physical exertion and/or heat stress."[4] Rhabdomyolysis is the breakdown of muscle tissue to the point where toxins, namely creatine kinase and/or myoglobin, spill into the blood and can contribute to serious illness. With many of the environments that the military operates, which include keeping our forces in the extremes of both temperature, humidity, and activity, a recipe for potential disaster is set. If we want to keep our forces fit to fight, we must take a preventative approach instead of a reactive one.

Acute exertional rhabdomyolysis is a subset of rhabdomyolysis that is most often found in our military forces. Olerud et al. found that during the early training phase, 40% of 337 military recruits had myoglobin in their urine, which is evidence of rhabdomyolysis.[5] This syndrome can affect our military trainees as well as operational forces, it is important to identify signs and symptoms of rhabdomyolysis to prevent it from happening.

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It is imperative to understand that our military forces are a unique and vulnerable population when it comes to any of our heat-related or exercise-induced syndromes such as heat exhaustion, heat stroke, and rhabdomyolysis. When considering the management of acute rhabdomyolysis of any etiology "early diagnosis and intervention is the key for treating rhabdomyolysis. It is essential to recognize the possible cause and limit it, while coping with the pathophysiological complications of rhabdomyolysis."[6]

The definitive diagnosis of rhabdomyolysis is defined as "a rises in creatine kinase greater than 5 times the normal limits"[7], but how do we identify rhabdomyolysis in a prehospital environment where routine lab draws are not readily available? Symptomatic

rhabdomyolysis may present as muscle pain, weakness, or dark colored urine **(Figure 2)**,[8] however 50% of patients with diagnosed rhabdomyolysis are completely asymptomatic[7]. A meta-analysis by Rodriguez-Capote et al., found sensitivity of uMB [Urine myoglobin] ranging from 38% to 100% in patients with serologically diagnosed rhabdomyolysis. This exam has low specificity, however, and there is limited data for its use in prehospital screening for rhabdomyolysis.[9]

Ultimately, a high clinical suspicion in at risk and vulnerable patient population is necessary to ensure early diagnostics and treatment. Additionally, preventative measures such as proper rehydration, step-wise progression towards high-intensity exercise, and adequate rest between exercises is recommended to prevent this dangerous disease in our troops[3].

The objective of this report is to highlight the potential at risk and vulnerable population we have in the military to heat-related syndromes and rhabdomyolysis. While keeping our forces fit, we owe it our service men and women to prevent and recognize a potentially severe injury. Furthermore, people in command positions must learn to weigh the risk and benefits of pushing troops in situations with extreme environmental conditions. It is a basic mathematic equation with profound results, if the engine overheats or doesn't have good fuel in it, it isn't going to run well.

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